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STUDIES OF DISCHARGE EXCITED ORGANIC VAPORS FOR EFFICIENT LASER--ETC(U)
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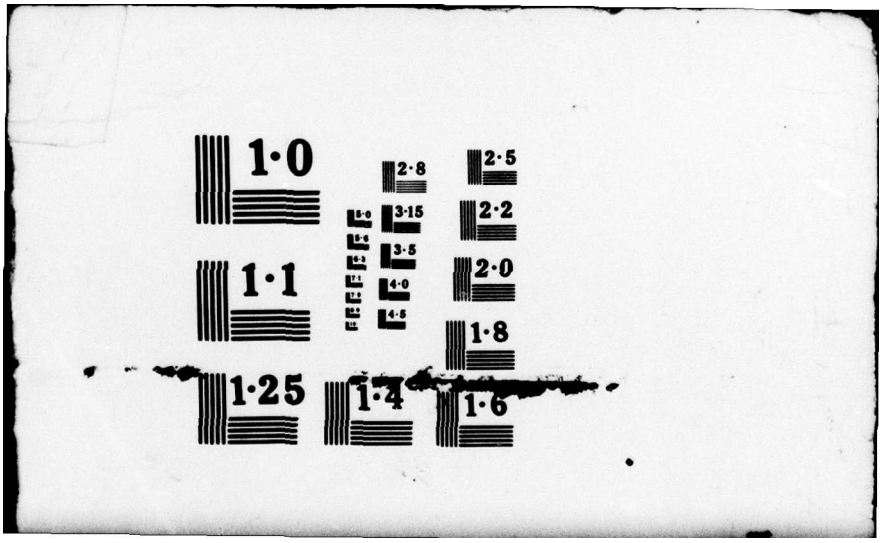
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LEVEL II

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STUDIES OF DISCHARGE EXCITED ORGANIC VAPORS FOR EFFICIENT LASER EMISSION.

FINAL REPORT.

T. K. Gustafson

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

dye vapor laser
density matrix
nonlinear optics
mode-locked dye lasers

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The areas of dye vapor lasers, diagrammatic calculations of the density matrix and mode-locked flashlamp dye lasers have been persued. The various results which have been obtained are summarized.

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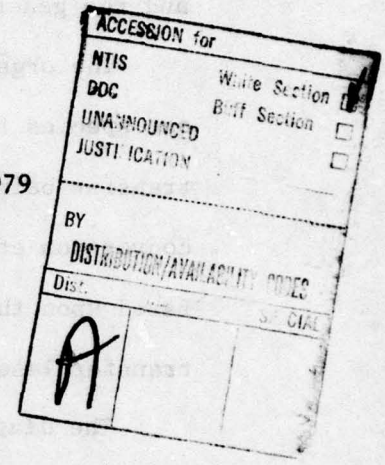
The basic problems studied on this grant were: the possibility of obtaining dye vapor laser action, the diagrammatic analysis of the density operator for the derivation of nonlinear optical suceptibilities, and the generation of organic dye laser mode-locked pulses.

The organic dye vapor work related to the radiative excitation of one species followed by an energy transfer to a second species, the transfer being detected by the fluorescence of the latter. A ten percent conversion efficiency was observed in a transfer from pyrene to perylene. Based upon these experiments it was believed that a discharge excited transfer laser was possible with a fair efficiency.

The diagrammatic work has lead to a specific and simple classification of perturbative non-linear optical effects and an evaluation of the nonlinear polarizations according to well established rules. A single diagram for each term of the density matrix is obtained, although it has been shown that several diagrams can contribute to one particular nonlinear effect. For certain approximations several diagrams which have a time-ordering relationship can be combined into a single one. This has in the past given rise to discrepencies in the definition of nonlinear optical susceptibilities. Further advantages to be gained by these double-sided Feynman graphs include the simplicity with which damping and Doppler effects can be included, the ease with which results pertaining to a quantized radiation field can be obtained and the simplicity with which transition rates can be obtained.

In a third phase of the work we have been constructing a mode-locked flash-lamp pumped dye laser in order to investigate certain nonlinear terms which have been predicted on the basis of the diagrammatic analysis.

The flashlamp pumped dye laser operates in the simmer mode and is pre-pulsed in order to increase efficiency and to increase the power out of the laser.



Students Supported on the ARO Grant

Bunsen Fan	Ph.D
Steven Yee	Masters, will obtain Ph.D. 1979
Timothy Ryan	Ph.D
Robert Davovdzadeh	Masters
M. Quedes	Will obtain a Ph.D. in 1979

Publications Pertaining to the Above

[1] S. A. J. Druet, B. Attal, T. K. Gustafson and J. -P. Taran, "Electronic Resonant Enhancement of Coherent Anti-Stokes Raman Scattering," Phys. Rev. A, 18, 1529 (1978).

[2] T. K. Yee and T. K. Gustafson, "Diagrammatic Analysis of the Density Operator For Nonlinear Optical Calculations: Pulsed and C. W. Responses," Phys. Rev., 18, No. 4 (1978).

[3] C. T. Ryan and T. K. Gustafson, "Vapor Phase Excitation Transfer from Pyrene to Perelene," Chem. Phys. Lett., 44, 241 (1976).

[4] T. K. Yee, B. Fan and T. K. Gustafson, "A Reliable Simmer-Enhanced Flashlamp-Pumped Dye Laser," submitted to Applied Optics.

Other Publications Carried Out While on ARO Support

[1] D. P. Siu and T. K. Gustafson, "Coherent Coupling of Radiation to Metal-Barrier-Metal Structures By Surface Plasmons," Appl. Phys. Lett., 31, 71 (1977).